

REMARKS

By the above amendment, the brief description of Figs. 46(a) - 46(f) has been corrected.

Should there be any questions, the Examiner is invited to contact the undersigned at the below listed number.

Respectfully submitted,
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MARKED-UP COPY OF AMENDED SPECIFICATION

Amendment to paragraph beginning at page 45, line 5:

Figs. 46(a) - 46(f) are diagrams [Fig. 46 is a diagram] for explaining a method of driving discharge cells in a conventional plasma display device.

P21159.A01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Mitsuhiro MORI et al.

Appl. No : Not Yet Assigned
(National Stage of PCT/JP00/07801)

Filed : Concurrently Herewith (International Filing Date November 6, 2000)

For : DISPLAY DEVICE AND METHOD OF DRIVING THE SAME

COVER LETTER SUBMITTING AMENDED PAGES OF APPLICATION

Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

Enclosed please find an English translation which includes pending claims 1-3 and 4-45 and the translation of the replacement sheets filed under Article 19(1) in the International Application. The originally filed replacement sheets in Japanese are on pages 86-94 in the concurrently submitted International Application as filed. In particular, the English translation of the replacement sheets are numbered pages 166-182 and replace pages 148-164 of the concurrently filed English translation of the International Application. Claims 1, 9, 10, 16, 17, 18, 19, 21, 22, 34, 35, 39, 40, 41, 44, and 45 had been amended; claim 4 had been canceled; and claims 2, 3, 5-8, 11-15, 20, 23-33, 36-38, 42, and 43 are unchanged.

Based upon the submission of amended sheets of claims, Applicants respectfully request examination on the merits of the application containing amended pages 166-182 containing claims 1-3 and 5-45, in place of originally filed claims 1-45 appearing on pages

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148-164 of the English translation of International Application No. PCT/JP00/07801 as originally filed.

Entry of the foregoing amendment to the claims is respectfully requested prior to examination and calculation of the filing fees in the above-identified patent application.

Should there be any questions, the Examiner is invited to contact the undersigned at the below listed number.

Respectfully submitted,
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23.03.01

World Intellectual Property Organization
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Amendment of the claims under Article 19(1) (Rule 46)

International Application No. : PCT/JP00/07801

International Filing Date : 06.11.00

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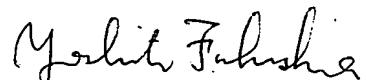
Applicant's or Agent's File reference : P24020-PO

Dear Sir

The Applicant, who received the International Search Report relating to the above identified International Application transmitted on 06.11.00, hereby files amendment under Article 19(1) as in the attached sheets.

Attached are replacement sheets pages 76-80 and 82-85. Thus, claims 1, 9, 10, 16, 17, 18, 19, 21, 22, 34, 35, 39, 40, 41, 44 and 45 are amended, claim 4 is canceled and claims 2, 3, 5-8, 11-15, 20, 23-33, 36-38 and 42, 43 are retained unchanged.

Very truly yours,



Yoshito Fukushima

Attachment :

(1) Amendment under Article 19(1)

9 sheets

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CLAIMS

1. (Amended) A display device for selectively discharging a plurality of discharge cells to display an image, characterized by comprising:

a display panel including said plurality of discharge cells;

a first driving circuit for applying a driving pulse to the selected discharge cell in said display panel to induce a first discharge; and

a second driving circuit for increasing, after a voltage of the driving pulse is reduced by the first discharge, the voltage of the driving pulse, to induce a second discharge subsequently to said first discharge.

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2. The display device according to claim 1, characterized in that said second driving circuit induces said second discharge while a priming effect produced by said first discharge is obtained.

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3. The display device according to claim 1, characterized in that an interval between the peak of said first discharge and the peak of said second discharge is not less than 100 ns nor more than 550 ns.

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4. (Omitted)

5. The display device according to claim 1,
characterized in that the interval between the peak of said
5 first discharge and the peak of said second discharge is not
less than 300 ns nor more than 550 ns.

6. The display device according to claim 1,
characterized in that the peak intensity of said second
10 discharge is not less than the peak intensity of said first
discharge.

7. The display device according to claim 1,
characterized in that
15 said plurality of discharge cells respectively include
capacitive loads, and
said first driving circuit comprises
an inductance circuit having at least one inductance
element having its one end connected to said capacitive load,
20 and
a resonance driving circuit for outputting said driving
pulse due to LC resonance by said capacitive load and said
inductance element.

25 8. The display device according to claim 1,

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characterized in that said first driving circuit comprises a first capacitive element provided outside said display panel as a current supply source for said driving pulse, said first capacitive element recovering charges stored in said 5 discharge cells.

9. (Amended) The display device according to claim 1, characterized by further comprising a third driving circuit for increasing, after the voltage of the driving pulse is 10 reduced by the second discharge, the voltage of the driving pulse, to induce third discharge subsequently to said second discharge.

10. (Amended) The display device according to claim 15 9, characterized in that said third driving circuit repeats an operation for increasing, after the voltage of the driving pulse is reduced by the discharge, the voltage of the driving pulse, to continuously induce discharges a plurality of times subsequently to the second discharge.

20

11. The display device according to claim 9, characterized in that

said second driving circuit comprises
a second capacitive element provided outside said 25 display panel as a current supply source for said driving

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pulse, and

a voltage source for charging said second capacitive element to a predetermined voltage.

5 12. The display device according to claim 1, characterized in that said driving pulse includes a driving pulse which makes the transmission from a first potential to a second potential and takes a maximal value and a minimal value at least once during the transition from the first 10 potential to the second potential, and further comprising 10 a final driving circuit for driving said driving pulse such that the transition speed from the final extreme value to the second potential is lower than the transition speed from the first potential to an extreme value immediately 15 after that and the transition speed from the subsequent extreme value to an extreme value immediately after that.

13. The display device according to claim 12, characterized in that

20 said final driving circuit comprises 20 a field effect transistor having its one end receiving said second potential, and 25 a current-limiting circuit for limiting a current of a control signal inputted to the gate of said field effect transistor.

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14. A display device for selectively discharging a plurality of discharge cells to display an image, characterized by comprising:

5 a display panel including said plurality of discharge cells;

a driving circuit for applying a driving pulse to the selected discharge cell in said display panel to induce a second discharge after inducing a first discharge;

10 a detection circuit for detecting the lighting rate of the discharge cells which are simultaneously turned on out of said plurality of discharge cells; and

15 a control circuit for controlling said driving circuit such that said driving pulse is changed depending on the lighting rate detected by said detection circuit.

15. The display device according to claim 14, characterized by further comprising

20 a conversion circuit for converting, in order to divide one field into a plurality of sub-fields and discharge the selected discharge cell for each sub-field to make gray scale expression, image data in the one field into image data in each sub-field,

25 said detection circuit comprising a sub-field lighting rate detection circuit for detecting the lighting rate for

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each sub-field,

 said control circuit controlling said driving circuit such that said driving pulse is changed depending on the lighting rate for each sub-field detected by said sub-field
5 lighting rate detection circuit.

16. (Amended) The display device according to claim 14, characterized in that

 said driving circuit comprises
10 a first driving circuit for increasing the voltage of said driving pulse to induce said first discharge, and
 a second driving circuit for increasing the voltage of said driving pulse to induce said second discharge after inducing said first discharge, and
15 said control circuit controlling said second driving circuit such that said driving pulse is changed depending on the lighting rate detected by said detection circuit.

17. (Amended) The display device according to claim 16, characterized in that said second driving circuit increases, after the voltage of said driving pulse is reduced by the first discharge, the voltage of the driving pulse, to induce said second discharge subsequently to the first discharge.

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18. (Amended) The display device according to claim 16, characterized in that said control circuit changes the timing at which said second driving circuit increases the voltage of said driving pulse depending on the lighting rate 5 detected by said detection circuit.

19. (Amended) The display device according to claim 16, characterized in that the higher the lighting rate detected by said detection circuit is, the later the timing 10 at which said second driving circuit increases the voltage of said driving pulse is.

20. The display device according to claim 16, characterized in that said control circuit controls, when the 15 lighting rate detected by said detection circuit reaches not less than a predetermined value, said second driving circuit such that said second discharge is induced subsequently to said first discharge.

20 21. (Amended) The display device according to claim 16, characterized in that said control circuit controls said second driving circuit so as to delay the timing at which the voltage of the driving pulse is increased with the increase 25 in the lighting rate detected by said detection circuit, and advance the timing at which the voltage of said driving pulse

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is increased when the lighting rate is increased to not less than the predetermined value.

22. (Amended) The display device according to claim 5 16, characterized in that said control circuit controls said second driving circuit so as to switch the timing at which the second driving circuit increases the voltage of the driving pulse when the lighting rate detected by said detection circuit reaches not less than a predetermined value 10 and change the number of pulses composing the driving pulse applied to the selected discharge cell in the display panel such that luminance is approximately equal before and after the switching of the timing at which the voltage of the driving pulse is increased.

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23. The display device according to claim 14, characterized in that said control circuit controls said driving circuit such that the higher the lighting rate detected by said detection circuit is, the longer the period 20 of said driving pulse is.

24. The display device according to claim 14, characterized in that said control circuit controls said driving circuit so as to switch the period of said driving 25 pulse when the lighting rate detected by said detection

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circuit reaches not less than a predetermined value and change the number of pulses composing the driving pulse applied to the selected discharge cell in said display panel such that luminance is approximately equal before and after 5 the switching of the period of said driving pulse.

25. The display device according to claim 15, characterized in that

10 said driving circuit applies, in the same sub-field, at least one of a first driving pulse for inducing a discharge once by applying one pulse and a second driving pulse for inducing said second discharge after inducing said first discharge, and

15 said control circuit controls said driving circuit so as to change the ratio of the number of times of application of said first driving pulse to the number of times of application of said second driving pulse depending on the lighting rate for each sub-field detected by said sub-field lighting rate detection circuit.

20

26. The display device according to claim 15, characterized in that

25 said driving circuit applies, in the same sub-field, at least one of a first driving pulse for inducing said first and second discharges at a first time interval and a second

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driving pulse for inducing said first and second discharges at a second time interval longer than the first time interval, and

5 said control circuit controls said driving circuit so as to change the ratio of the number of times of application of said first driving pulse to the number of times of application of said second driving pulse depending on the lighting rate for each sub-field detected by said sub-field lighting rate detection circuit.

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27. The display device according to claim 26, characterized in that the period of said second driving pulse is longer than the period of said first driving pulse.

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28. The display device according to claim 26, characterized in that said control circuit controls said driving circuit such that the higher the lighting rate for each sub-field detected by said sub-field lighting rate detection circuit is, the higher the ratio of the number of 20 times of application of said second driving pulse to the number of times of application of said first driving pulse becomes.

29. The display device according to claim 26, 25 characterized in that said control circuit controls said

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driving circuit so as to increase the ratio of the number of times of application of said second driving pulse to the number of times of application of said first driving pulse with the increase in the lighting rate for each sub-field

5 detected by said sub-field lighting rate detection circuit, and further decrease the ratio of the number of times of application of the second driving pulse to the number of times of application of the first driving pulse with the increase in the lighting rate when the lighting rate is increased to

10 not less than a predetermined value.

30. The display device according to claim 16, characterized in that said first driving circuit comprises a first capacitive element provided outside said display panel as a current supply source for said driving pulse.

31. The display device according to claim 30, characterized in that said first capacitive element recovers charges stored in said discharge cell.

20

32. The display device according to claim 16, characterized in that

25 said plurality of discharge cells respectively include capacitive loads, and

25 said first driving circuit comprises

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an inductance circuit having at least one inductance element having its one end connected to said capacitive load, and

a resonance driving circuit for outputting said driving 5 pulse due to LC resonance by said capacitive load and said inductance element.

33. The display device according to claim 32, characterized in that said inductance circuit includes a 10 variable inductance circuit capable of changing an inductance value, and further comprising an inductance control circuit for changing the inductance value of said variable inductance circuit depending on the lighting rate detected by said detection 15 circuit.

34. (Amended) The display device according to claim 16, characterized in that

said driving circuit further comprises a third driving 20 circuit for increasing, after the voltage of said driving pulse is reduced by the second discharge, the voltage of said driving pulse, to induce a third discharge subsequently to said second discharge, and

said control circuit controls said third driving 25 circuit such that said driving pulse is changed depending on

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the lighting rate detected by said detection circuit.

35. (Amended) The display device according to claim 9, characterized in that

5 said third driving circuit repeats an operation for increasing the voltage of the driving pulse after the voltage of the driving pulse is reduced by the discharge, to continuously induce discharges a plurality of times subsequently to the second discharge, and

10 said control circuit controls said third driving circuit such that said driving pulse is changed depending on the lighting rate detected by said detection circuit.

36. The display device according to claim 34, 15 characterized in that

 said second driving circuit comprises a second capacitive element provided outside said display panel as a current supply source for said driving pulse, and

20 a voltage source for charging said second capacitive element to a predetermined voltage.

37. The display device according to claim 36, characterized in that said voltage source includes a variable 25 voltage source capable of changing its output voltage, and

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further comprising

a voltage control circuit for controlling the output voltage of said variable voltage source such that the higher the lighting rate detected by said detection circuit is, the 5 lower a charging voltage for said second capacitive element becomes.

38. The display device according to claim 36, characterized in that said voltage source includes a variable 10 voltage source capable of changing its output voltage, and further comprising

a potential detection circuit for detecting a potential of said driving pulse which is changed by said first discharge, and

15 a voltage control circuit for controlling an output voltage of said variable voltage source such that the larger the amount of change in the potential detected by said potential detection circuit is, the lower the charging voltage for said second capacitive element becomes.

20

39. (Amended) A method of selectively discharging a plurality of discharge cells to display an image, characterized by comprising the steps of:

applying a driving pulse to the selected discharge cell 25 to induce a first discharge; and

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increasing, after a voltage of said driving pulse is reduced by the first discharge, the voltage of the driving pulse, to induce a second discharge subsequently to the first discharge.

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40. (Amended) The method of driving a display device according to claim 39, characterized by further comprising the step of

increasing, after the voltage of said driving pulse is reduced by the second discharge, the voltage of the driving pulse, to induce a third discharge subsequently to the second discharge.

41. (Amended) The method of driving a display device according to claim 40, characterized in that the step of inducing said third discharge further comprises the step of repeating an operation for increasing, after the voltage of said driving pulse is reduced by the discharge, the voltage of the driving pulse, to continuously induce discharges a plurality of times subsequently to the second discharge.

42. The method of driving a display device according to claim 39, characterized in that said driving pulse includes a driving pulse which makes the transition from a first potential to a second potential and takes a maximal

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value and a minimal value at least once during the transition from the first potential to the second potential, and further comprising the step of

driving said driving pulse such that the transition
5 speed from the final extreme value to the second potential is lower than the transition speed from the first potential to an extreme value immediately after that and the transition speed from the subsequent extreme value to an extreme value immediately after that.

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43. A method of selectively discharging a plurality of discharge cells to display an image, characterized by comprising the steps of:

detecting the lighting rate of the discharge cells which
15 are simultaneously turned on out of said plurality of discharge cells; and

changing said driving pulse depending on the lighting rate detected by said detecting step to apply the driving pulse to the selected discharge cell, and inducing a second
20 discharge after inducing a first discharge.

44. (Amended) The method of driving a display device according to claim 43, characterized in that

the step of inducing said first and second discharges
25 comprises the steps of

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increasing the voltage of the driving pulse applied to the selected discharge cell, to induce the first discharge, and

increasing the voltage of said driving pulse to induce
5 said second discharge after inducing said first discharge, and changing said driving pulse depending on the lighting rate detected by said detecting step.

45. (Amended) The method of driving a display device
10 according to claim 44, characterized in that the step of inducing said second discharge comprises the step of increasing, after the voltage of said driving pulse is reduced by the first discharge, the voltage of the driving pulse, to induce the second discharge subsequently to the
15 first discharge, and changing the timing at which the voltage of said driving pulse is increased depending on the lighting rate detected by said detecting step.